Interventional Quarter ISSUE 5 - December 2011

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The Changing Shape of Illness

Overcoming Every Hurdle: Veterinary IR

The Early Days with Anders Lunderquist

Trauma Interventions

Interventional Radiology in the Emergency Room

The Best of Both Worlds: Traumatology and IR

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Interviews . Reports . Case Studies from the world of image-guided minimally invasive therapy

A Welcome from the Editor

Dear Readers,

Since IQ's launch in 2009, our circulation has grown from 7,000 to 45,000: an increase of more than 640% within two years. This is thanks to major support from CIRSE (Cardiovascular and Interventional Radiological Society of Europe) and above all continued interest from you, the reader. IQ has gone from strength to strength and continues to report on the inspiring work done by interventional radiologists at the cutting edge of medicine, together with their colleagues from other medical specialties.

With this continued success in mind I am delighted to present the current edition of IQ, which focuses on the vital role of interventional radiology (IR) in the management of trauma. Traumatic injury can affect anyone and can arise from violent encounters, traffic accidents, falls, or industrial and occupational injuries. IR provides minimally invasive techniques that are helping to reduce the frequency of tragic outcomes. As always, we open the issue by explaining how IR is making a difference to patients' lives in a range of clinical scenarios.

For an actively haemorrhaging patient rapid treatment is key to survival. As every second counts, the best outcome depends not only on the most appropriate medical technology being available, but also on the speed, skill and efficiency of the waiting trauma team. We will take a closer look at how the organisation of emergency departments, including the positioning of equipment and 24-hour staff availability, is essential for an effective life-saving service.

The leading role of IR in catheter-based techniques is crucial and should be supported by those who care for trauma patients. It must also be acknowledged that currently only well-trained interventional radiologists can offer this full 24/7 service to trauma patients.

This edition is supported with further articles showing the broad scope of the discipline, including reports on veterinary IR, and how rising obesity levels are presenting new clinical challenges.

I would like to thank our expert contributors for providing their case studies, opinions and insight. It is through them sharing their experience that we are able to see shining examples of best practice and learn of the benefits that IR brings to the multidisciplinary trauma team. Like in so many other areas of modern medicine, such collaboration between IR and other disciplines in trauma care is not merely important, but essential to giving patients the best chances of survival and continuing quality of life.

Jim A. Reekers
Editor-in-Chief

General Information

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An invitation to our readers

IQ is your magazine, and we would welcome your views and your news. Readers who wish to comment on any of the issues raised (or who would like to raise any of their own) are most welcome to submit letters to the Editor. Likewise, if you have any promotions, awards, honorary lectures or other tit-bits you'd like to share with the interventional community, please send them to us by post or by email.

We look forward to hearing from you!
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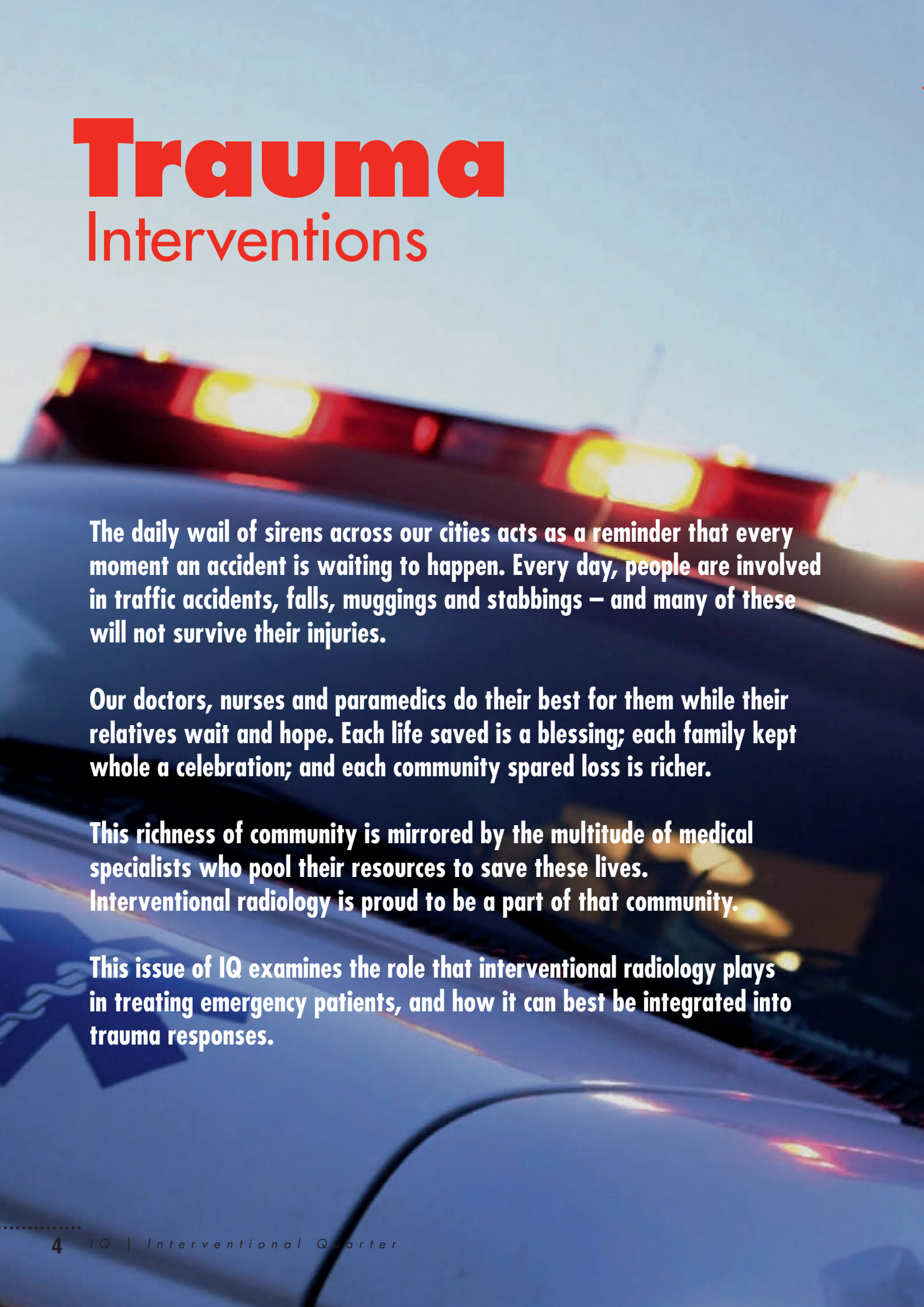


Trauma
Interventions

The daily wail of sirens across our cities acts as a reminder that every moment an accident is waiting to happen. Every day, people are involved in traffic accidents, falls, muggings and stabbings – and many of these will not survive their injuries.

Our doctors, nurses and paramedics do their best for them while their relatives wait and hope. Each life saved is a blessing; each family kept whole a celebration; and each community spared loss is richer.

This richness of community is mirrored by the multitude of medical specialists who pool their resources to save these lives. Interventional radiology is proud to be a part of that community.

This issue of IQ examines the role that interventional radiology plays in treating emergency patients, and how it can best be integrated into trauma responses.

The impact of accidents

Broken bones hurt, but it is the bleeding that can accompany injury that poses the greatest danger to trauma patients. Luckily, stopping bleeding is what interventional radiology (IR) does best.

All kinds of patients are rushed to the Accident and Emergency Department each day, but the most common injuries are caused by traffic accidents, falls or violence (see Table 1). Globally, more than 5 million people die from injuries each year – more than HIV/AIDS, TB and malaria fatalities combined. Injuries also seem to disproportionally affect young people, whose social and econo - mic contribution to society is far from complete.

These injuries frequently result in bleeding, which depending on the severity and type of injury, can be difficult to stop.

As the patient loses more blood, they enter a downward spiral of decreased blood pressure, hypothermia and acidosis. Unless the bleeding can be stopped, the patient will not survive; and the more blood that is lost, the less likely that the bleeding will cease before it is too late. Early intervention is vital.

Penetrating and blunt injury

Broadly speaking, injuries can be broken into two groups: blunt and penetrating trauma. Both can cause massive damage to a frail human body, and both can be treated by interventional radiology.

In Europe, **blunt trauma** is by far the most common injury type seen in the Accident and Emergency Department, and covers any injury caused by blunt force, such as being hit by a car, falling from a height or receiving any bangs or blows to vulnerable areas.

Penetrating trauma is comparatively much rarer in Europe, but still occurs all too frequently. This category includes any trauma caused by piercing the body, such as stab wounds, bullet wounds or impalement.

How IR can help

IR's role in trauma management is manifold. As a discipline rooted in high quality imaging, interventional radiologists are uniquely placed to both perform and interpret diagnostic scans – and if indicated, they can then use these techniques to deliver minimally invasive treatment.

Furthermore, IR is able to perform these life-saving techniques throughout the body, from major organ groups to damaged blood vessels, from head to toe. IR has been used to treat injuries of the head, face, neck, limbs, chest and abdomen – for both blunt and penetrating injuries.

"It's really satisfying: you find where the bleeding point is, you access it, and you put a little coil in and block the artery. Once you've done that, just a small intervention, the patient usually recovers very quickly. Young patients in particular recover very quickly, and it's always a joy when the anaesthetist says, 'the pressure's back up.'

"Sometimes they've entered the downward spiral of acidosis, hypoxia, and hypothermia: once they've entered that, it's very difficult to save them. That's why it's vital that we IRs are involved right from the start."
Peter Ellis

Some injuries are more common than others, just as some injuries are more suited to IR treatment than others. IR is particularly effective in areas where surgical intervention would be impossible or too risky, such as the pelvis, and many larger trauma units now include IR as a first-line treatment for certain injury categories.

The Trauma Team

The techniques offered are impressive, but the reality is that many accident patients suffer from multiple injuries, and may need multiple therapies. Interventional radiologists, surgeons and traumatologists must pool their expertise to ensure that each patient receives the combination of therapies that they need to recover.

0-4 years	5-14 years	15-29 years	30-44 years	45-69 years
#8: Road traffic injuries (1,740)	**#1:** Road traffic injuries (4,180)	**#1:** Road traffic injuries (39,300)	**#4:** Road traffic injuries (33,200)	**#16:** Road traffic injuries (36,500)
#17: Violence (690)	**#9:** Violence (640)	**#3:** Violence (14,900)	**#8:** Violence (22,600)	
#19: Falls (660)	**#13:** Falls (530)	**#13:** Falls (3,590)	**#15:** Falls (7,900)	

Table 1: Causes of death by age group and frequency, European Region, 2004 (WHO Statistics)

The following pages will examine some of the more common occurrences in detail: stab wounds, blunt trauma of the solid organs, pelvic trauma, aortic trauma and limb injuries, as well as looking at how these treatments can best be integrated into treatment protocols. The minimally invasive therapies available ensure that these damaged patients are aided in their recovery by the very gentlest of options.

IR in the management of solid organ trauma

The human body has evolved to protect its vital and delicate organs as best it can, but the dangers of the modern world can be a fearsome opponent. Car crashes, falls from heights and stabbings can often render the protection of our ribs and hips useless, leaving our organs vulnerable to damage or destruction.

Solid abdominal organs, such as the liver, kidneys or spleen, are an area of speciality for the trauma IR.

Not only is open abdominal surgery risky for a patient (with additional blood loss and risk of infection), but it is often not suitable for tackling the problem. If a blow to the liver has caused blush-bleeding throughout the organ, there is little that a surgeon can do to cure it. The IR, on the other hand, can access the problem without opening the patient, and can locate and selectively embolise the main sources of bleeding.

Prof. Pierre Goffette,

IR at the Cliniques Universitaires St. Luc, Brussels, explains the importance of IR in treating solid organ trauma:

Exemplary approach
The most important thing when dealing with a trauma patient is to decide quickly what treatment is most suitable. In my hospital, we have a set decision-making pathway: if the patient is deeply unstable and bleeding profusely, we send them directly for damage-control laparotomy, where the injury is packed to stop the bleeding. This is not to repair the trauma, simply to stop the bleeding. Once they are stable, we usually send them to the angiosuite, where we IRs will locate the source of the bleeding and embolise it, in order to avoid delayed rebleeding once the packing material has been removed.

Trauma team
More haemodynamically stable patients, or unstable patients responding transiently to initial resuscitation are sent straight to CT, and from there to angio, surgery or for conservative care, as is necessary. This is decided by a team of emergency doctors: surgeons, IRs and intensive care doctors. In our hospital, we rarely perform surgery for liver, kidney, spleen or pancreatic trauma in stabilised patients – IR is used wherever possible. Our surgical colleagues use their expertise to repair injuries to the bowel or diaphragm.

The aim of any trauma team should be damage limitation – where feasible, conservative treatment is best; if active intervention is needed, it should be as gentle as possible. Don't forget that surgery necessarily entails further trauma, and is best used only when absolutely necessary.

The role of IR
Usually, traumatic injuries to the organs are graded in terms of AAST criteria (American Association of Surgery for Trauma), but these are not ideal for identifying patients who will rebleed – which are the patients who should be receiving IR. Stabilising the bleeding is priority, even if surgical intervention is also needed for bowel or parenchymal repair or resection.

Asset to patient and hospital
While IR can seem expensive, it can actually be quite cost-effective once you look at the bigger picture. It can be very cost-effective for the institution: we reduce the length of the hospital stay, the length of intensive care stay, and the need for open surgery (which is very expensive). The patients go home sooner and have fewer problems of being absent from work.

Providing round-the-clock cover for a trauma service takes a lot of time and energy, but it's also very exciting, because you immediately see that you are saving patients. I am very happy to make myself available for emergency coverage, because in just 10 minutes we can save a patient, avoid difficult surgery, or prepare an easier surgery. Recovery is easier for our patients, and I'm proud to offer these services to my trauma team and our patients.

Real life-saver

A 49-year-old woman was admitted to our emergency department in the evening after a severe road-traffic accident. She was conscious and haemodynamically stable at admission, but complained of shortness of breath and diffuse right-side abdominal pain and tenderness.

Initial whole-body CT showed a huge right haemothorax caused by multiple rib fractures, a grade III liver trauma (right lobe) and a sacral fracture. The patient was initially sent to the Intensive Care Unit for observation and drainage of the haemothorax.

Four hours later, she suddenly developed hypovolemic shock, requiring immediate intubation and resuscitation with a large amount of colloids and packed blood. A repeat CT scan demonstrated massive intraperitoneal active bleeding arising from the injured liver. The patient was immediately transferred to the angiography suite to perform super-selective embolisation with glue. Embolisation was chosen to avoid a very demanding and risky surgical hepatectomy in this haemodynamically unstable patient.

Despite significant haemodynamic improvement, an increased need for transfusion led us to repeat the angiography several hours later. A persistent oozing from a right phrenic artery was stopped by selective embolisation with glue and coils.

No additional surgery was needed during the follow-up. A percutaneous drainage of the subcapsular hepatic bilio-haematoma was performed for local decompression at day 12.

The patient left the hospital five weeks after admission, showing complete recovery with preserved liver function.

Doctor's View

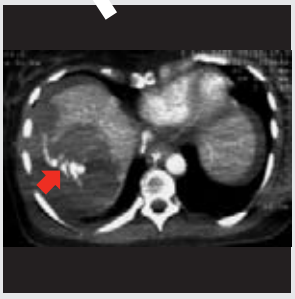
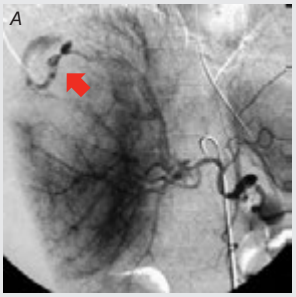


Fig. 1: CT scan 4 hours after admission: massive active bleeding (arrow) arising from the injured liver.



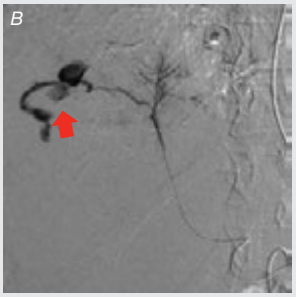


Fig. 2A & 2B: Global (A) and selective (B) hepatic angiography demonstrated active bleeding (arrows) at the dome of the right liver.

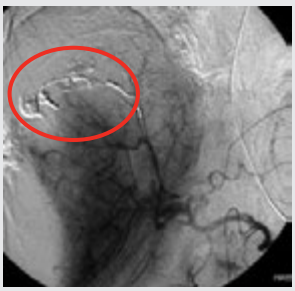


Fig. 3: Control hepatic angiography after selective embolisation with glue (glue can be seen within the selection).

IR in the management of pelvic trauma

Pelvic trauma is common following traffic accidents and falls. The bones of the hip form a bowl shape at the base of the spine, within which sit many of our major organs, and past which the main vessels and nerves to the legs run. Accordingly, any damage to the pelvis can have serious implications – vital organs and blood vessels can be damaged, and blood can easily pool in the curved hollow of the pelvis.

This complex area is quite difficult to access surgically, and treatment has typically consisted of external fixation (pelvic traction) – fixing the damaged bones to an external frame to reduce pressure on the organs and to properly align the bones before healing begins.

Pelvic traction is still widely and successfully employed to treat haemorrhaging patients, but where organs or vessels have been severely damaged, additional intervention may be needed.

Dr. Peter Ellis,

IR at the Royal Victoria Hospital, Belfast, explains the importance of IR in treating pelvic trauma:

Most deaths that occur due to pelvic fractures are as a result of haemorrhage. In addition, pelvic injuries are associated with severe abdominal and retroperitoneal injuries.

Most patients who experience haemorrhage as a result of pelvic fracture are stabilised by external fixation. It is the group of patients (perhaps 5-10%) in whom bleeding continues despite pelvic traction that benefit from interventional radiology (IR) management.

Previously, these patients were either explored surgically or treated conservatively. Surgical exploration brings in the additional risks of anaesthesia and sepsis. Moreover, there is further blood loss and the risk of reopening a bleeding point which is beginning to heal. Often the surgeon will not see the site of bleeding and, in addition, the surgeon can only see the outside of a vessel and can miss intimal injuries.

Benefits of IR

The role of the interventional radiologist is to perform early angiography, and if needed, embolisation. Rapid treatment of haemorrhage will hopefully prevent the vicious circle of hypotension, hypothermia, acidosis and coagulopathy. Multi-slice CT with contrast enhancement is particularly useful in indentifying the presence of pelvic haematoma and the site of bleeding.

Technical success should approach 100% for embolisation in patients with a defined bleeding point or abnormality. Should the patient remain haemodynamically unstable despite external fixation, then early angiography and embolisation is essential as delays increase mortality[1].

Exemplary approach

The interventional radiology team must be available 24 hours a day, 7 days a week. This means that an interventional radiologist should be within the hospital and ready to perform the procedure within 30 minutes of the initial call. Such rotas are often difficult to organise, but are essential – a part-time service is a disservice to our patients. This service has been offered at the Royal Victoria Hospital, Belfast since 1997.

Asset to hospitals

Offering innovative IR therapies positively contributes to the reputation and performance of any trauma centre. This helps not only the patients themselves, but also the hospital as a whole.

The economic benefits to a hospital are that we can prevent a patient entering that rapid downhill spiral of acidosis, hypoxia, and hypothermia, perhaps keeping them out of intensive care, or reducing the length of their stay there.

Trauma patients tend to be younger members of society and further economic benefits perhaps lie in saving the life of an individual who is working and supporting a family. It's actually a uniquely satisfying part of our job. We have the skills to save these patients from massive surgical procedures, from potential death and we have a duty to utilise them.

1 *Cook R, Gillespie I, Keating J. The role of angiography in the management of haemorrhage from major pelvic fractures. J Bone Joint surg 2002; 84: 178-182.*

Real life-saver

A 62-year-old man arrived at our hospital following a fall from a height. He was experiencing severe pelvic and back pain, moderate hypotension and tachycardia (elevated heart rate). CT demonstrated extensive pelvic fractures and several lumbar spine compression fractures. There was extensive haematoma in the pelvis and retro - peritoneum (abdominal cavity). External pelvic traction was applied, but the patient remained haemodynamically unstable, and so angiography was performed by the on-call interventional radiologist.

Initial access was via the left femoral artery, and a flush angiogram of the pelvis demonstrated a bleeding point (arrow) from a branch of the anterior division, internal iliac artery on the right side (Fig. 1).

This vessel was selected and gelfoam slurry injected into the anterior division. The bleeder continued to fill from a proximal branch and the entire right internal iliac was embolised with gelfoam (as seen within the selection) (Fig. 2).

Control angiography after embolisation no longer shows signs of bleeding (Fig. 3).

The patient stabilised and, following treatment for his pelvic and lumbar fractures, was discharged after 16 days.

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>

Doctor's View

Fig. 1

Fig. 2

Fig. 3

IR in the management of chest trauma

Trauma to the chest can often result in damage to the heart or its major blood vessels, particularly the aorta. The aorta is the largest human blood vessel, distributing oxygenated blood throughout the body. Injury can cause the aorta and other vessels to be punctured, dissected or otherwise damaged.

Thoracic aortic injury (TAI) is the second most common cause of death in patients with blunt injury. Being such a major vessel, it is estimated that 85% of these patients die before reaching the hospital[1,2].

However, for those that do make it, it is essential that quick and effective treatment is at hand – and IR provides just that…

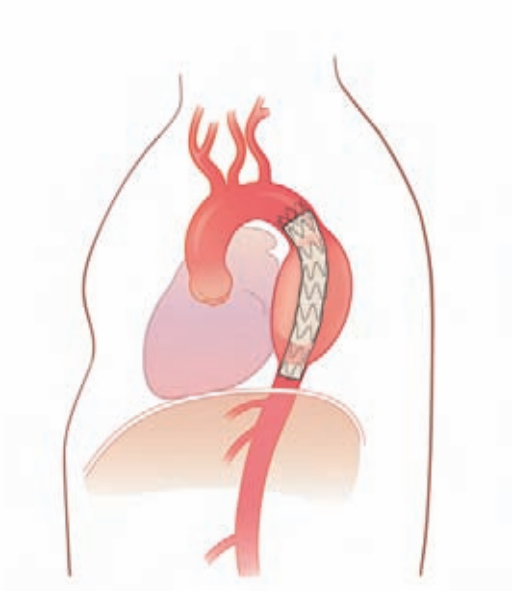
Prof. Josef Tacke,

IR at the Klinikum Passau, Germany, explains the importance of IR in treating trauma of the chest:

An unfortunately large number of trauma patients present with damage to the aorta, and due to the high mortality rate associated with this injury, swift treatment is essential.

Benefits of IR

We interventional radiologists offer a very efficient treatment for this emergency. With most kinds of traumatic injury, damage limitation is the goal, and so the additional intrinsic risks of surgery are avoided if at all possible.



TEVAR – Thoracic Endovascular Aortic Repair
"Using image-guidance and catheters, we can deliver a stent-graft to the site of injury, which provides support for the damaged vessel, as well as obstructing the bleeding, without interfering with the usual flow of blood."- Tacke
© IUSM Visual Media

Using image-guidance and catheters, we can deliver a stent-graft (a kind of prosthetic scaffolding) to the site of injury, which provides support for the damaged vessel, as well as obstructing the bleeding, without interfering with the usual flow of blood.

Evidence

In recent years, this procedure – TEVAR (thoracic endovascular aortic repair) – has become more widely used. This is due to the sound body of evidence that shows that the procedure has a lower mortality and morbidity rate than traditional surgical therapies in the thoracic aorta.

In one meta-analysis of ruptured descending aortic repair, including 224 patients treated between 1995 and 2011 (mean age 70 years), a significantly lower 30-day mortality was revealed in the TEVAR group (Jonker et al., J Vasc Surg 2010). Moreover, myocardial infarctions and paraplegia occurred more often after open repair.

Another meta-analysis comparing open versus endovascular repair in 589 patients (mean age 38.8 years) suffering from traumatic rupture of descending thoracic aorta also revealed a significant lower procedure-related and 30-day mortality after TEVAR (Xenos et al., J Vasc Surg 2008). In a subanalysis, the risk of procedure-related spinal ischaemia was also significantly lower in the endovascular group.

Exemplary Approach

In our institute and elsewhere, TEVAR is the treatment of choice for thoracic aortic injury, and open repair in thoracic aortic diseases is now reserved predominantly for ascending and aortic bow pathologies.

1 Garcia-Toca, Arch Surg 2010.
2 Aladham, J Comput Assist Tomogr. 2010.

Real life-saver

Recently, an 18-year-old male patient was brought to our hospital following a high-speed car accident. A CT scan was performed immediately upon admission, and showed a typical injury at the aortic isthmus with a covered rupture and mediastinal haematoma (arrow) (Fig. 1).

Additionally, rib fractures, lung contusion and liver laceration were seen. While these were managed conservatively, the aortic lesion was rated as life-threatening, and an immediate repair was performed. The patient was intubated, received a chest drainage and was moved directly into the angiography suite. Circulation parameters were kept stable by anaesthesiology.

Simultaneous to an arterial cut-down of the right common femoral artery by a vascular surgeon, a retrograde puncture of the right brachial artery and placement of a 5 Fr graduated pigtail catheter in the ascending aorta was performed. Under image-guidance, we placed a small prosthetic tube (stent-graft) into the thoracic aorta to obstruct the bleeding source (arrow) (Fig. 2).

A final angiography in two projections showed the correct placement of the endograft, which covered the rupture site completely (Fig. 3). All catheters were removed and the femoral access was closed surgically. Including the initial CT examination, the operating time was 1.5 hours in total.

© Yellowj

The young patient recovered well and had his breathing tubes removed within the next few days. A follow-up CT showed a correct sealing of the rupture site without stent migration – a great result that shows the enormous value of a team approach.

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Doctor's View

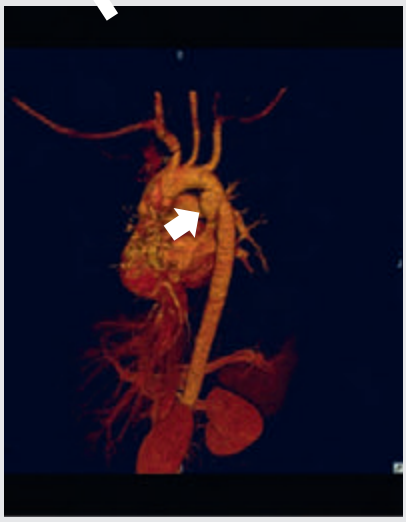

Fig. 1: 3D surface reconstruction of trauma CT. Covered rupture of thoracic aorta in the region of previous Lig. Botalli.

Fig. 2: Angiography with unreleased endograft in final position.

Fig. 3: Final angiogram with excluded rupture site.

IR in the management of peripheral trauma

Peripheral trauma, which can include injury to the limbs, may occur alone or as part of a multi-trauma incident. Vascular injuries of the extremities represent a large proportion of all vascular trauma cases, as the major arteries in these delicate anatomical regions are more vulnerable, being closer to the surface of the skin.

As well as leading to death through haemorrhage, severe injuries to these parts of the body can compromise blood flow to specific areas. The resulting ischaemia can mean that even if the patient survives, they may need to have the affected limb amputated, unless swift and appropriate intervention is carried out.

Dr. Konstantinos Katsanos,

IR at Rion University Hospital, Patras, Greece, explains the role of IR in treating peripheral trauma:

Interventional radiology (IR) is the leading discipline involved in minimally invasive control of bleeding in trauma cases. Embolisation is well accepted for prompt arrest of deep visceral and pelvic bleeding, whereas covered stents may be inserted and deployed through remote percutaneous access under local anaesthesia.

Benefits of IR
Covered stents are ideal for controlling haemorrhage of big trunk arteries from the aorta right down to the peripheral arteries. They can seal off an arterial bleed, while still preserving the blood flow through the vessel, which is crucial for limb survival.

Asset to patient and hospital
The endovascular repair of traumatic peripheral arterial injuries with covered stents has further advantages: less blood loss and tissue damage, reduced operative time and morbidity, shortened hospital stay, quicker patient recovery, and reduced healthcare costs.

Then…
Before the availability of IR, open surgery with invasive exploration of the traumatised area would have been the alternative, often resulting in arterial ligation and even limb amputation in the case of peripheral arterial injuries with extensive tissue damage.

...Now
Nowadays, minimally invasive techniques are used in a wider range of injuries. For example, a polytrauma patient in our department was once treated with a combination of thoracic aortic endograft (TEVAR) for aortic tear, hypogastric artery embolisation for pelvic haemorrhage and peripheral covered stent placement for femoral artery transection. All endovascular procedures were finished within six hours of patient admission.

Exemplary approach
IR interventions in arterial trauma cases have been available for more than 10 years in Greece, and have been accepted with great enthusiasm by the trauma surgeons in recent years, with the introduction of low-profile sheaths and instruments making the procedures even more expedient and even less traumatic.

Trauma interventions are the foremost life-saving procedures modern IR has to offer. They are expedient, minimally invasive and have a huge positive impact on patient outcomes. IRs can, with a few exceptions, achieve prompt arrest of almost all sources of bleeding inside the human body through remote endovascular access. This is all done while avoiding any distortion of normal anatomy and minimising associated morbidity and mortality, which in the case of peripheral trauma often means saving limbs from amputation.

An IR suite is a well recognised key element of every modern trauma centre of reference.

Real life-saver

A 29-year-old man had swelling of the left forearm following a recent penetrating stab wound and was referred to our department for investigation.

Using duplex ultrasonography, we discovered that the pulsatile mass was due to the ulnar artery bleeding into an area within the arm that was 4cm in size (pseudoaneurysm). This was accompanied by extensive bleeding into the surrounding soft tissue.

After consultation with the vascular surgeons we opted for an endovascular approach, in order to avoid invasive surgical exploration of the arm. In the angiography suite, catheter access to the vascular system was gained through a puncture in the brachial artery in the upper arm. Digital angiography was performed to give a final diagnosis, and to guide the treatment that followed straight after.

Digital angiography confirmed the presence of a complex pseudoaneurysmal sac at the mid level of the ulnar artery in the left arm (white arrow). The black circle shows how the blood was flowing to the outside of the artery (Fig. 1).

A short balloon-expandable covered stent (white bracket) was introduced to close the leaking hole in the artery, while preserving the blood flow through the vessel (Fig. 2).

Immediate closure of the leak was achieved (white arrow) and no more blood could flow through the hole (shown by the disappearance of the black circle). Note the excellent blood flow through all three major arteries of the forearm supplying the hand (the ulnar artery, the radial artery and the interosseous artery in the middle) (Fig. 3).

The procedure was complete within 20 minutes and compression was finally applied to close the puncture in the upper arm, through which the intervention was carried out. The patient was well enough to go home the next day.

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Doctor's View

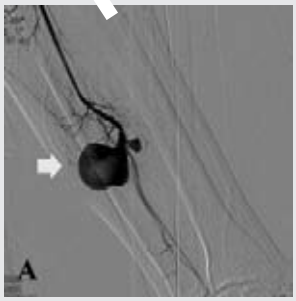

Fig. 1

Fig. 2

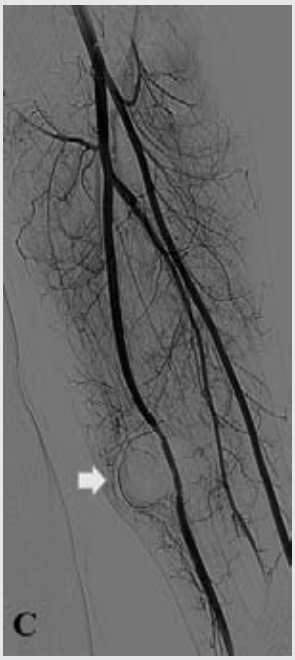

Fig. 3

IR in the management of penetrating trauma

While relatively rare in Europe, penetrating trauma is still a concern for emergency departments, particularly in large urban areas such as London. It is generally associated with social inequality and a high crime rate. Knife wounds and gunshot wounds can follow domestic arguments, gang conflict or robberies, but are naturally more common within social groups where carrying a weapon is commonplace.

Violence ranks in the top 10 causes of death for Europeans aged 5-44 – while these may also include blunt injuries, such as those resulting from punching or kicking, penetrating injury constitutes a large number of these cases. Accordingly, it is essential that emergency services can offer effective treatment for these injury types.

Prof. Coert de Vries,

IR at Bloemfontein University Hospital in South Africa, explains how IR is used to treat penetrating injuries:

We deal with a relatively high number of penetrating trauma injuries – converse to European norms, I would say that a higher proportion of our trauma cases result from penetrating injury than from blunt.

Our hospital is in Free State, which is located in the middle of the country, and is known as South Africa's bread basket. Despite this prosperity, the province experiences quite significant social and economic inequality, which one might expect in a country that has undergone massive social change in recent times. Around a quarter of South Africans are unemployed, and life can be very tough. Accordingly, the violent crime level is very high.

Interventional radiologists can guide a catheter through an artery to the lesion where coils (minute, soft, metal spirals) are then released. This prompts the body to form blood clots that consequently treat the bleeding point or aneurysm. Image highly magnified. © ev3 Inc.

High volume of cases

Although I do many types of interventions, treating trauma patients is a daily task for South African IRs. We get cases in every day. Luckily, most of these injuries are what are called low-velocity penetration (from handguns), rather than the high-velocity injuries you get from combat rifles – they are extremely difficult to treat.

The role of IR

These days, we try to treat as many patients as possible conservatively. Should CT show an enlarging haematoma or a large vessel injury, we'll use IR to block it off. Due to economic constraints as much as anything else, we try to have a practical approach to these injuries, and we tend to use coils and diagnostic catheters to treat stab wounds.

In trauma, many patients will die from the complications, rather than the injury itself. Thus, it makes sense that we choose a treatment method that entails as few complications as possible. There is no point going in with maximum effort if you can make a big difference with the minimally invasive approach.

Due to our high trauma volumes, I give many lectures on trauma IR. The reason I am so passionate about it is that you really make a difference. The patient (often a young patient with a family to look after) is broken, and you try to repair them. The repair is not always perfect, but at least you can bring the patient back, at least you can keep them alive. And that's very rewarding – it's a very dramatic difference to make.

Real life-saver

Recently, a 30-year-old man was brought to our trauma unit on a Saturday evening with a bleeding wound in his back. On his way home from work, he'd been stabbed and robbed of his weekly income.

On examination, we found a laceration in the left high lumber region, which was duly sutured, but a CT scan also showed a peri-renal haematoma and 2cm laceration of the left kidney, so he was kept in for observation. By Sunday evening, the haematoma was still present, but the patient was getting anxious to return to his family and to work, an anxiety underlined by the theft of his whole week's income.

A follow-up CT demonstrated a false aneurysm in the kidney and it was decided that the IR team should embolise. We went in with a 4 Fr catheter from the right groin, and the false aneurysm was embolised with coils.

The patient was discharged the next day, and was able to go back to work and provide for his family.

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Doctor's View

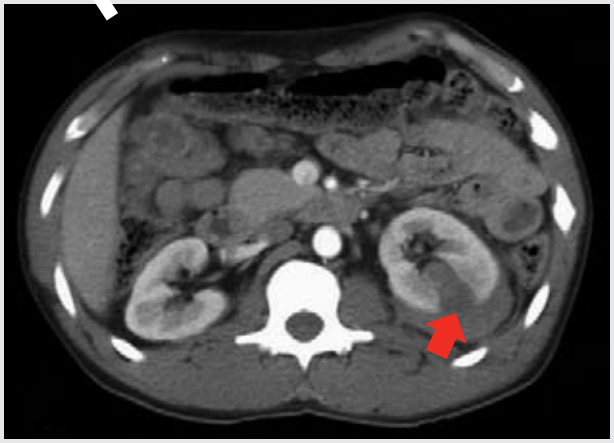


Fig. 1: Laceration of left kidney and associated haematoma.

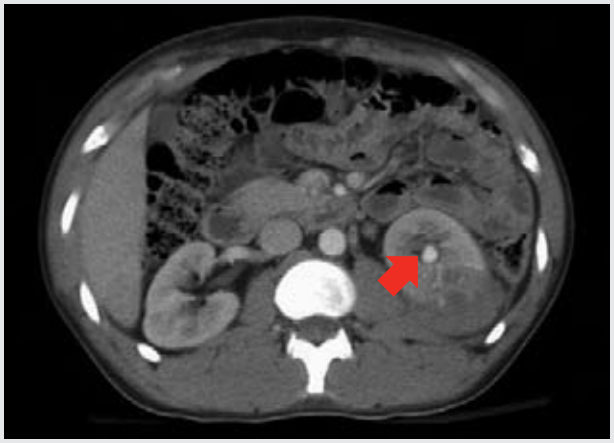


Fig. 2: False aneurysm in left kidney.

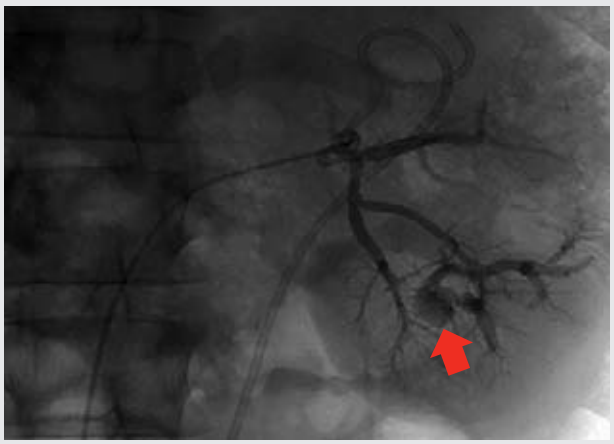


Fig. 3: Selective angio of left renal artery demonstrates a false aneurysm.

Fig. 4: After coil embolisation of vessel leading to aneurysm.

Trauma – Interventional Radiology's life-saving contribution

Dr. Trevor Cleveland, IR, Sheffield Teaching Hospitals, UK

As outlined in the previous pages, interventional radiology (IR) provides vital treatments for patients who have sustained severe physical trauma. Yet some clinicians are still unaware of the role of IR in trauma care, and how it can help avoid some of the invasive problems associated with open surgery. Not considering IR treatments for trauma patients could result in serious consequences such as prolonged bleeding, unnecessary transfusion of blood products and the cardiovascular consequences of major blood loss.

Endovascular approaches to the treatment of trauma can be applied to hepatic and splenic injuries, renal trauma, pelvic and limb injuries and many other less common sites of traumatic bleeding. IR treatment options are usually based around:

- embolisation
- stent-grafts
- stents

Embolisation for trauma

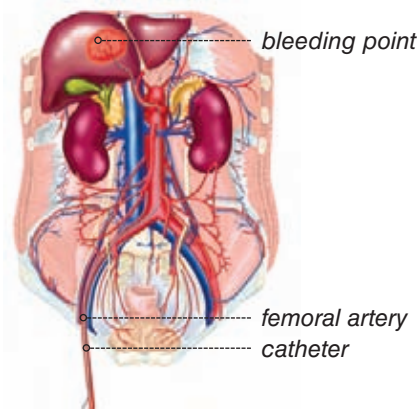
In the context of trauma, embolisation is the process whereby a blood vessel is deliberately blocked, thereby interrupting the flow in that vessel, and stopping the bleeding.

If the problem area of a bleeding artery can be identified, permanent or temporary embolisation may be achieved by the delivery of special particles, liquids, or devices.

Stent-grafts

Depending on the nature of the injury, however, embolisation may not always be appropriate. IR offers stent-grafts (covered stents) as an alternative method for sealing a hole or laceration produced in an artery as a result of trauma.

Covered stents, being a metal frame upon which a covering is mounted or incorporated, are well suited to sealing arterial tears without blocking the free passage of blood through the vessel. They therefore stop a vessel bleeding out as well as preserving the blood supply to the body parts downstream from the injury.



Embolisation: delivery of clotting agents (glue, coils, gelfoam, particles, etc.) directly to an area that is bleeding or to block blood flow to a problem area.

Bare stents

Not all endovascular treatments for trauma rest on the cessation of bleeding. In some circumstances the arterial wall is disrupted and this in turn leads to an intimal tear, which causes the artery to be occluded and can result in end-organ ischaemia.

In such situations it is often possible to pass a guidewire to cross the occluded segment and join the two patent regions. Once this has been achieved, the intimal disruption can be pushed back into position by the placement of an open mesh stent. In this way, blood flow can be re-established in the normal direction.

Providing the best service

As indicated above, interventional radiology has a great deal to offer in the field of trauma, both in stopping life-threatening bleeding and the re-establishment of tissue perfusion.

If the benefits of these techniques are to be made fully available, their use in routine trauma practice must become more widespread. For this to happen, trauma surgeons and other specialists need to know that IR has much to offer in this area of patient care. Furthermore, investment must be made in the availability of suitably trained interventional radiologists to support multidisciplinary trauma teams.

Unfortunately, it is a fact of life that trauma typically occurs at unsocial hours and presents clinical teams with stressful and difficult clinical scenarios. Interventional radiologists are increasingly making themselves available, through sustainable and organised rotas, to offer these life saving interventions wherever and whenever they are needed.

Covered stents: small, metal mesh tubes covered by a durable fabric.

The Goal of Complete Trauma Care

It is clear that interventional radiology (IR) is a very important asset to trauma management, yet even among major trauma centres a complete trauma care provision, including adequate IR cover, is not always present.

Hospitals providing trauma care are described according to the level of service they offer, Level I Centres providing the most comprehensive care. Here, patients with severe injuries will have access to the most sophisticated technologies and the most experienced and well-rounded trauma teams.

Usually sited in urban areas to serve large populations with a high incidence of trauma, these centres have round-the-clock availability of highly skilled clinicians and dedicated support staff, who are organised and trained for quick-response. Major trauma centres are defined by their provision of the complete range of options for trauma management; ideally including IR alongside damage control surgery and non-operative management (see Fig. 1), which is a requirement in some countries.

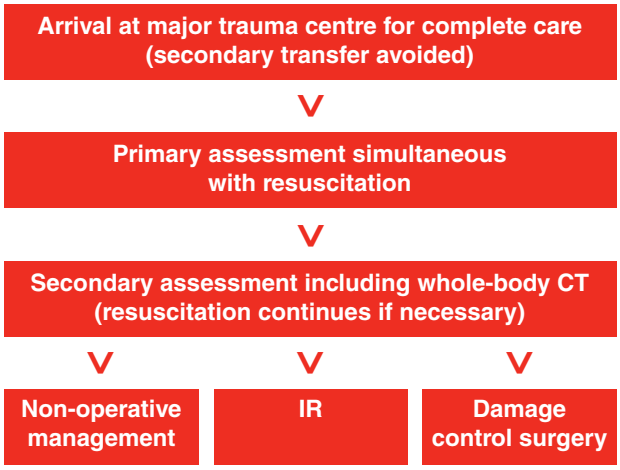


Fig. 1: Major trauma centre: patient journey (adapted from CIRSE Standards of Practice document: Quality Improvement Guidelines for Endovascular Treatment of Traumatic Haemorrhage*)*

Standards of practice

The Cardiovascular and Interventional Radiological Society of Europe (CIRSE) recently produced Standards of Practice trauma guidelines, published at www.cirse.org *(Quality Improvement Guidelines for Endovascular Treatment of Traumatic Haemorrhage)*.

Dr. Otto van Delden, one of the authors of this pan-European guideline, explains its significance:

"This important document highlights several key facts about IR's involvement in trauma care. It is vital to offer a 24/7 service, to be called early in the course of the case, to have all the logistics in place, and to have on-call rotas for everything.

"There is still a lot of work that needs to be done in implementing this, but the movement towards Level I Trauma Centres is everywhere in Europe. Smaller hospitals are not equipped to handle severe trauma and it should be centralised. This Standards of Practice paper is a real step in the right direction."

A centre having full diagnostic and treatment capacity should receive patients directly for complete care, avoiding the need for a risky secondary transfer. The efficient set-up and planned workflow at the centre allows resuscitation to proceed alongside primary and secondary assessment, and ensures the availability of CT which allows accurate and speedy diagnosis leading to the most appropriate treatment and increased chances of survival.

> "The movement towards Level I Trauma Centres is everywhere in Europe"
> *van Delden*

A main requirement for successful integration of imaging and IR into the trauma care pathway is a true multidisciplinary infrastructure

IR on the team

A main requirement for successful integration of imaging and IR into the trauma care pathway is a true multidisciplinary infrastructure. Here, IR features alongside traumatology, surgery, intensive care and the other specialties involved in emergency care.

Even where the value of IR in the emergency department is recognised, this is not enough if specialist staff are not present at the required time. Trauma services need an on-call rota that includes IR, to ensure comprehensive 24-hour cover, especially as trauma cases tend to arrive out-of-hours, and always at short notice.

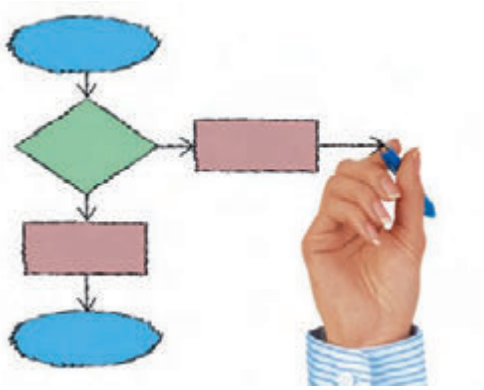
© Tim Arbaev

Interventional radiologists are increasingly on-site after office hours, so are available to lend their expertise to the care of incoming trauma patients. With this availability, 24-hour rotas can be devised to guarantee a service that is superior to ad hoc arrangements.

Such complete rotas can only be assured if staff numbers are adequate. This in turn is affected by provision of IR training. The strengthening of education and recruitment to IR are therefore also of concern if enough IRs with the required level of experience are to be available to staff a dedicated trauma service.

An agreed plan of action

As rapid decision-making is essential in trauma cases, clear protocols are developed and agreed for emergency patient management. Clear leadership and well-defined roles are necessary if the various backgrounds and training experiences of all team members are to be integrated. The rapid clinical decision-making of the trauma team is supported by standard treatment algorithms, which allow efficient decision-flow based on the results of investigations and scans.



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CT scans are especially important in making a quick and complete diagnosis, allowing appropriate progression along the treatment pathway. Evidence suggests that timely CT use increases the probability of survival for polytraumatised patients[1].

As rapid decision-making is essential in trauma cases, clear protocols are developed and agreed for emergency patient management

1 Lancet, 2009 Apr 25;373(9673):1455-61. Epub 2009 Mar 25.

CT is now considered the standard scan in polytrauma cases and has a central role to play in major centres of trauma care

The right tools for the job

Being a rapid imaging technique that is suited to the detection of active bleeding, the use of CT should not be delayed in favour of ultrasound or X-ray. CT is now considered the standard scan in polytrauma cases and has a central role to play in major centres of trauma care.

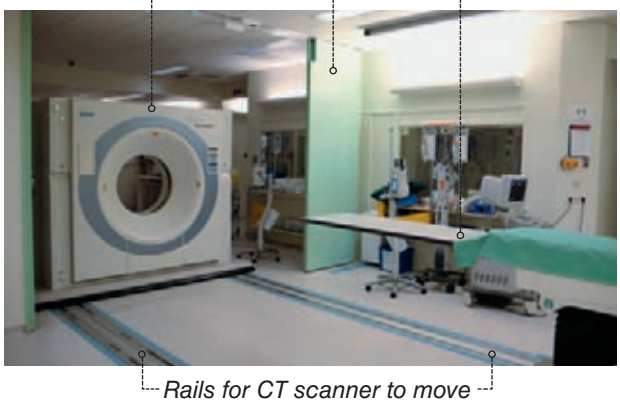
The CT scanner should be nearby for quick access rather than in another part of the hospital. Ideally, the emergency department should have its own CT capability to guarantee efficient workflow and to prevent the time-wasting and dangerous transfer of critically ill patients. A dedicated CT scanner in the emergency department also avoids delays and inconvenience to non-emergency patients who have scans scheduled in the radiology department.

In trauma cases time is everything, and **CT is FASST: fast, appropriate, sensitive and specific in trauma.**

The emergency department should have its own CT capability to guarantee efficient workflow and to prevent the time-wasting and dangerous transfer of critically ill patients

Amsterdam Trauma Workflow

An example of an efficient working environment integrating IR is the "Amsterdam Trauma Workflow", implemented at the Academic Medical Centre, Amsterdam. In this innovative set-up, a sliding CT gantry sits on rails to serve two emergency rooms, with a radiation-shielding wall that can close behind. Furthermore, CT can be performed feet-first so IV-lines and monitors do not need to be re-positioned.



Amsterdam Trauma Workflow: Potentially harmful transfer of patients from trolley to table is avoided by using a single trauma trolley on which the patient stays from resuscitation onwards. All other equipment, including the CT scanner, is compatible with this trolley.

Centre networking

Limited resources are sometimes a fact of life but the greatest tragedy is when patient care suffers due to a lack of organisation. Just as teamwork within a hospital is important, formal co-operative networks between hospitals are necessary for making sure trauma cases of all levels are referred to the appropriate centre immediately, to be managed in the best way possible.

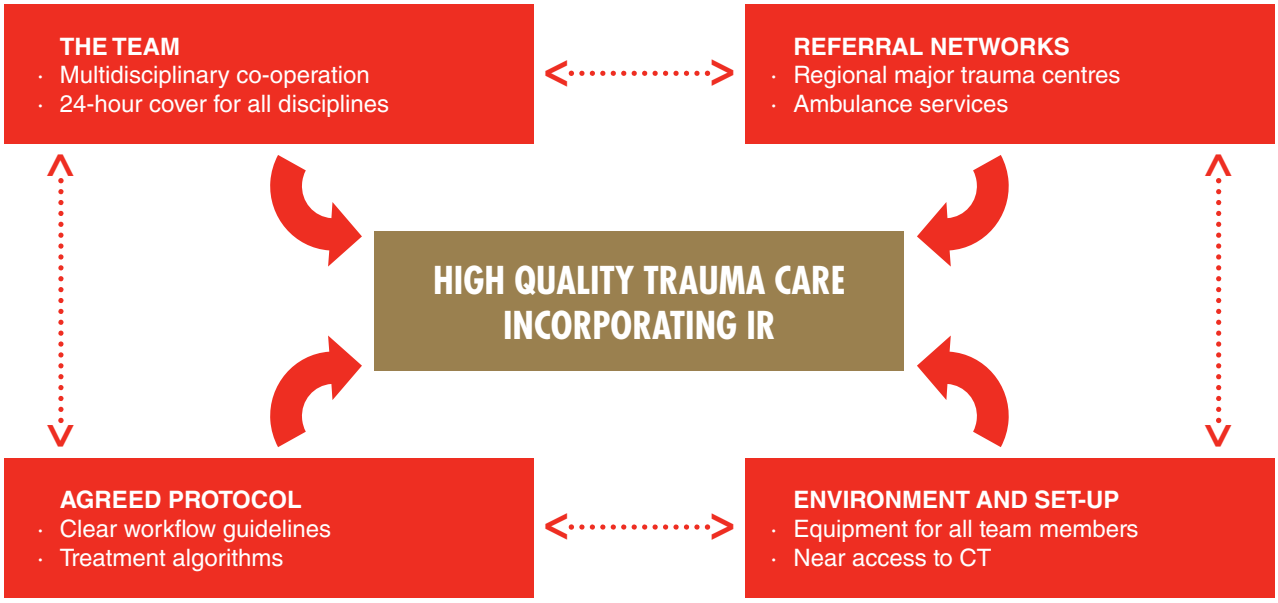


Fig. 2: Summary of criteria for complete trauma care

Ambulance and rescue services, acute trauma centres, and rehabilitation centres should all be part of this extended network to improve patient survival and safeguard later quality of life.

A.M.

Trauma Interventions Trials and Registries

Trial: a study carried out with the purpose of testing a new medical treatment on a defined group of people. The results are compared with a group that are treated using another method and/or a control group.

Registry: a (retrospective) collection of data about a certain treatment or illness. Using the compiled data, conclusions can be drawn about effectiveness of a particular treatment method.

EVAR

Immediate Management of the Patient with Aneurysm Rupture: Open Versus Endovascular Repair (IMPROVE)

Contact
Prof. Janet Powell, Imperial College London, UK
Date opened
September 2009
Status
Recruiting
Description
This research aims to determine whether a strategy of preferential emergency endovascular repair reduces both the mortality and cost of ruptured abdominal aortic aneurysm.
ClinicalTrials.gov Identifier: NCT00746122

Embolisation

Outcome after Conservative and Surgical Treatment of Splenic Injuries after Blunt Abdominal Trauma

Contact
Dr. Pietro Renzulli, Bern University Hospital, CH
Date opened
January 2002
Status
Completed
Description
Retrospective study which aims to investigate the outcome after conservative (with or without transcatheter arterial embolisation) and surgical treatment of splenic injuries.
ClinicalTrials.gov Identifier: NCT00910182

www.intervention-iq.org
www.clinicaltrials.gov
www.cirse.org
www.controlled-trials.com
www.who.int/trialsearch
clinicaltrials.mayo.edu

Stent-grafting

Study to Determine if the Valiant Stent Graft is Safe and Effective in Treating Patients who have a Blunt Thoracic Aortic Injury (RESCUE)

Contact
Dr. Rodney White, Harbor UCLA, US
Date opened
March 2010
Status
Recruiting
Description
The purpose of this study is to determine if the Valiant stent-graft is safe and effective in treating patients who have a blunt thoracic aortic injury (BTAI).
ClinicalTrials.gov Identifier: NCT01092767

Vertebroplasty

Evaluating Vertebroplasty and Kyphoplasty for Reducing Trauma-related Fractures

Contact
Dr. Pascal Kouyoumdjian, Centre Hospitalier Universitaire de Nîmes, FR
Date opened
August 2011
Status
Not yet recruiting
Description
The primary objective of this study is to compare trans - cutaneous vertebroplasty and kyphoplasty for reducing trauma-related fractures.
ClinicalTrials.gov Identifier: NCT01402167

IQ takes no responsibility for the content of the individual trials and registries; please refer to their source for further information.

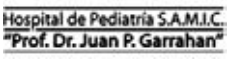
Please note, this does not constitute an exhaustive overview of trials and registries. If you are aware of a trial or registry which may be of interest to our readers, please feel free to contact us at info@intervention-iq.org.

***Prof. David Gregg**, Trauma Surgeon, Stanford University Medical Center, Stanford/USA*
"We have been utilising IR technology for 15 years. The use of this technology has been increasing over the years as improvements in imaging and procedures have evolved. We use IR in the acute setting to stop bleeding or to revascularise ischaemic tissues. This most commonly occurs in pelvic fractures but we have employed stents and embolisations to virtually all body parts. Very often this has allowed us to treat the injury without open operations in patients who are poor operative candidates (concomitant head trauma, hypothermia, coagulopathy). **"The use of stent systems has completely revolutionised the treatment of contained aortic tears. Currently, a Level I Trauma Centre cannot manage without a vigorous IR programme."**

Worldview

IR in Trauma Teams – A Vital Contribution…

Experts from medical disciplines involved in trauma care spoke to IQ about the inclusion of IR in multidisciplinary trauma teams. A similar opinion is echoed around the globe: properly integrated IR can improve the overall treatment results in the emergency department and help save lives.



***Dr. Sergio Sierre,** Head of the Department of Interventional Radiology, Hospital Nacional de Pediatría, Buenos Aires/Argentina*
"We are by far the largest paediatric hospital in Argentina. The multidisciplinary trauma team was established in the early 2000s and included interventional radiologists from the start. I particularly encourage the non-radiologist members of the trauma team to observe our IR procedures to give them a better insight into how IR works. **"The other members of the team strongly support us as a consequence of the results we achieve as a team. Undoubtedly, this close and co-ordinated work of the group leads to significantly successful results.** For example, a few weeks ago a 5-year-old, haemodynamically-compromised patient arrived at the emergency room after a car accident with a pulsatile giant cervical mass. After a Doppler exam in the emergency room this mass was assumed to be a huge upper internal carotid pseudo-aneurysm and the trauma team decided to refer this child to us. Some minutes later this patient was successfully treated by means of endovascular techniques, blocking the vascular lesion with use of a stent-graft and saving the child's life."

***Prof. Peter Reimer**, Director of Diagnostic Radiology, Klinikum Karlsruhe, Karlsruhe/Germany*
"Many medical conditions in the emergency department require immediate treatment. IR has the capacity to deliver this immediate care in a manner that is gentle and adds as little strain as possible to patients that may already be in a critical or life-threatening condition. **"Trauma teams can significantly improve their treatment results with an active IR group. Patients' prognoses can be significantly improved. It is essential for the team to be aware of the possibilities of IR and logistics that allow a proper utilisation in an emergency case.** Properly integrated in a multidisciplinary team, IR methods complement or substitute open surgical methods and in general complete the overall emergency provision of a hospital."

***Prof. Andrew Holden,** Director of Interventional Radiology, Auckland Hospital, Auckland/New Zealand*
"IR now plays a critical role in the management of the trauma patient. The modern trauma team now involves emergency, trauma, anaesthesia, intensive care specialists and importantly IR. **Early consultation with IR allows rapid assessment of imaging and multidisciplinary decision making as to the best methods of management.**
"Only recently this helped save the life of a 17-year-old female involved in a high-speed traffic accident. The patient was very unstable and went straight to theatre for open surgical packing of a severe liver laceration. Instability persisted and the surgeons noted retroperitoneal and pelvic haematoma so the patient was transferred to IR. Angiography revealed active bleeding from the renal artery and internal iliac arteries – these were occluded with catheter embolisation. An arch aortogram demonstrated a ruptured thoracic aorta which was managed with an endograft. Finally, bilateral nephrostomies were performed as both collecting systems were obstructed by pelvic haematoma and bladder injury was suspected."

***Prof. Yasuo Nakajima,** Chairman of Radiology, St. Marianna University School of Medicine, Kanagawa/Japan*
"Time matters in trauma care. In our hospital interventional radiologists are integrated in the emergency department. As soon as we get word from an approaching ambulance with a trauma case we initiate care as a team by making all necessary preparations in order to be able to begin the haemostatic process as soon as the patient arrives. **Indeed we are promoting the concept of 'Trauma IR', which focuses on optimising the speed with which haemostatic IR procedures are employed. This system is very effective in providing IR treatments, which are less invasive and faster, to traumatised patients as soon as possible. IR has great potential in trauma care.**
"Recently we treated a young man who had fallen from a great height. Whole-body CT demonstrated bleeding related to fractures of the pelvis, ribs and thoraco-lumbar vertebrae, as well as damage to both renal arteries. We performed embolisation for a total of 13 arteries and inserted a stent on the right renal artery. The procedure was completed after 78 minutes and the patient was finally discharged without haemodialysis or other additional intervention."

The Best of Both Worlds

Offering patients every opportunity

One of the most high-volume trauma centres in Europe is located in the Royal London Hospital, where strict protocols and seamless co-operation are the order of the day.

IQ speaks to Prof. Karim Brohi (KB), a Vascular and Trauma Surgery Consultant, and Dr. Matthew Matson (MM), an Interventional Radiologist, to find out the secret of their success.

What does IR bring to the trauma department?

KB: For many trauma patients, the hours following the injury are the most critical. Uncontrolled bleeding poses a great risk to the life of the patient, and it is of vital importance that the bleeding be stemmed.

Interventional radiology (IR) techniques offer an opportunity to stop the bleeding, allowing patients to move on to intensive care and have their physiology restored. IR offers the advantage of avoiding the further trauma that major surgery inevitably causes.

IR has revolutionised the management of pelvic trauma (where surgery can be challenging or impossible) and is used in organ-salvage protocols for spleen, liver and kidney injury. We also use IR for the management of traumatic aortic injuries, and again here IR has produced significant improvements in the care and outcomes of these patients.

MM: IR is also used in the management of complications of these patients, such as retained haemothoraces, intra-abdominal abscess formation, etc. We are also evaluating future roles for IR in fields such as traumatic vascular revascularisation.

How is treatment decided upon? Is there a set protocol?

MM: The trauma team leader manages the case; there is room for some discussion but decisions need to be taken in a swift, timely manner. We use pre-agreed decision algorithms to try and standardise patient pathways. For example, a hypotensive patient with a pelvic fracture and no free fluid in his abdomen will be treated with embolisation as the first-line treatment rather than surgery.

How are the logistical difficulties of inter-specialty co-operation overcome in your hospital?

KB: No hospital is ideally set up for trauma patients, as hospitals have to manage many different types of patients with different needs and priorities. It is important that trauma pathways incorporate the specific logistic and infrastructure characteristics of the hospital. Treatment decisions don't just include patient characteristics, but also the expertise on site and the availability of operating rooms and IR suites, which can vary depending on the time of day.

How is IR made available 24 hours a day?

MM: We set up an IR on-call service about 10 years ago by mutual agreement of radiologists and management. There was an early realisation that IR could provide unique treatment options for trauma patients.

There are now six IRs working at the Royal London Hospital, and I think this is the minimum reasonable number to provide round-the-clock coverage. Many hospitals simply do not have enough capable individuals, and these hospitals should try to join forces, if geographically viable. If you are trying to run a dedicated trauma service, it's not acceptable to have an informal phone-around arrangement to see if anyone is sober and available. Our hospital has a target of provision of IR within 30 minutes day and night.

What role does hospital management have to play in ensuring good use of resources?

KB: ***The trauma service runs a Trauma Quality Assurance Programme that monitors the performance of the trauma system and addresses any deficiencies in clinical and system care. This programme is clinically led, but supported with a management structure that provides authority to this peer-review process across multiple specialties and administrative groups. This allows us to ensure best use of our resources.***

(l-r) Dr. Matson and Prof. Brohi

Our mortality from pelvic trauma haemorrhage has decreased from about 50% to 20% with the incorporation of IR pelvic embolisation into our management protocols

Do you feel there is a good general awareness of what IR can offer?

MM: There is good awareness among the emergency physicians and trauma surgeons. Sadly our patients and their relatives are often unaware of the interventions that happen during those frenetic first few hours, particularly since we seldom see them subsequently.

Societies such as the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) and the British Society of Interventional Radiology (BSIR) have done good work in producing documents setting out standards of care that can be used by hospital management.

Is there any advice you would give to other trauma units who have yet to start collaboration with their IR colleagues?

MM: Begin discussions and develop agreed treatment pathways before the patient who needs IR arrives in the hospital. Trying to arrange things at two in the morning with a patient bleeding to death in front of you inevitably leads to errors and poor outcomes.

Can you give a recent example where IR's involvement meant the difference between life and death?

KB: We see this on a regular basis at our Major Trauma Centre. For example, our mortality from pelvic trauma haemorrhage has decreased from about 50% to 20% with the incorporation of IR pelvic embolisation into our management protocols.

C.M.

Images courtesy of Barts and The London NHS Trust

Barts and The London NHS
NHS Trust

The Royal London Hospital was designated as a trauma centre in 1988 and has had a 24/7 emergency IR service running for ten years. The trauma centre is now a leading specialist centre with an international reputation for providing excellent care to polytraumatised patients.

The centre is also home to London's Helicopter Emergency Medical Service (HEMS), also known as London's air ambulance, and in 2008, treated over 1,400 patients – more than any other facility in the UK.

The Role of IR in the ER

A shining example of emergency care from Lebanon

Prof. Al-Kutoubi spoke to IQ about the development of emergency interventional radiology (IR) at the American University of Beirut Medical Centre (AUBMC) in Lebanon, and how robust medical management protocols, multidisciplinary working, and round-the-clock IR availability are key to helping save lives.

A growing and vital service

The IR service in Lebanon was actually started in the mid-70s by one of my predecessors at the AUBMC, the late Dr. Ghassan Rizk, beginning with a variety of basic things like biopsies and drainages. Many more advanced procedures have been introduced over the years, particularly since I took over the chairmanship of the department about 12 years ago. We now have the full gamut of interventional procedures available, from the treatment of aneurysms in the brain to all kinds of vascular and non-vascular procedures. Most procedures that are done worldwide are also available here.

The 15 years of civil war in Lebanon helped to promote interventional radiology for emergency cases. With patients who are casualties of war there is often much to offer through IR procedures.

My predecessors who were providing the IR service throughout this period had to make do with limited supplies and generally improvise. For example, the common tube we use for oxygen, they would use for drainage. I think that the contribution of IR during those years helped establish the role of the specialty in Lebanon in the emergency context.

Patients who came in having been hit by bullets, bleeding from the leg for example, were frequently taken straight to the radiology department to stop the bleeding to start off with. This was one way to efficiently deal with casualties. Because there were so many other patients requiring different treatments, the surgeons had their hands full doing other things.

It is actually quite interesting that the AUBMC and another major teaching hospital, Hotel Dieu de France, were spared from attacks, because the warriors knew that this was their only chance of survival if they ever needed emergency treatment.

The situation today

This kind of emergency IR service is actually confined to a few major hospitals for a variety of reasons, including the need for available radiologists who can provide a 24-hour service, which is not very common in Lebanon.

Also, the way that emergency cases are handled has an effect. Currently we do not have a centralised ambulance service that takes patients to specified units, although there is an Emergency Hospital being built for that purpose. At the moment, there is an ad hoc arrangement whereby patients may be lucky enough to be close to one of the major teaching hospitals where an interventional radiology service is available and they can be treated there. Otherwise they are taken to a local set-up, where interventional procedures may not be available on-site and they'll either be treated by other means, sometimes unnecessarily, or they might receive incomplete or inappropriate treatment. That is the unfortunate side of having variable and patchy coverage rather than a national service.

IR's place in the emergency room

A wide variety of IR procedures are performed in the context of emergency situations. These range from simple drainage procedures of blocked and infected kidneys to embolisation and closure of bleeding points, which could be from penetrating injuries or from ruptured aneurysms.

Patient access to these services is often through referrals to IR, which depend on both the relationship bet - ween the interventional radiologists and the other physicians, as well as on the familiarity with the concept of interventional radiology at that particular institution.

At the AUBMC, IR is an established service. Referral from the emergency department to the interventional service happens quite frequently and quite early on in each case. This is because what we do is well known and we have a good working relationship with our physicians and surgeons. We've always provided a 24/7 service which also helps in referral: if you are available then people will refer to you more frequently! I think if a 24-hour service were available everywhere then many more interventional procedures could be performed on many more patients.

1902 AUBMC
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The AUBMC is an accredited institution by JCI (Joint Commission International); an international body based in the US. One of the requisites for accreditation is the development of management policies across the institution to deal with various clinical situations.

Prof. Aghiad Al-Kutoubi

Well organised and collaborative

The coverage for emergency procedures at the AUBMC is provided by three IRs and a neuro-endovascular surgeon, who handles a fair number of the neuro-emergencies. We also have vascular surgeons in the team who do endovascular procedures. The cases are shared but in the radiology department itself, most of the work is done by the radiologists. However, the neuro-surgeons and vascular surgeons come to our department and do their cases here too, so it is a collaborative effort.

Out of the three interventional radiologists, two admit patients for day cases only and one has full admission privileges to bring in patients under his own care at any time. In some cases; let's say if a patient is referred to me for a brain aneurysm, I admit this patient to the neurosurgery or neurology service in collaboration with one of my colleagues there, so continuous care is provided by the team on the floor but I would do the procedure and see the patient. This set-up works very well.

We recently expanded and modernised our emergency service, and a new emergency department opened a couple of years ago. They have their own policy, their own way of channelling patients and defined protocols for their patients. Indeed, the agreement of management protocols for common problems is one of the important factors with regard to the referral of emergency cases.

For example, we have a protocol, developed in co-operation with the cardiologists, for management of patients who come into the ER with acute chest pain. So when a patient arrives with acute chest pain we all know the pathway he goes down according to the protocol. Similarly, a patient with a spleen injury, or subarachnoid haemorrhage, for example, is subject to a different management protocol which may result in referral to the interventional team or the surgeons.

There are well-developed policies for common pathways. We don't have policies for everything, of course, but that will happen in time.

Hospital management sure of benefits

Representatives of management; the chief medical officer or the associate dean for medical affairs, for instance, might decide to audit the work in the ER and part of the audit might include the interventional procedures that are performed on the patients there. We have had many audits and we continue to have them as part of performance improvement and so far so good.

The non-medical managers are also very supportive and rely on the expertise of the physicians when it comes to making decisions about up-front medical care.

The future of IR in emergency care

We've been doing complex interventions for some time at the AUBMC. The treatment of intracranial bleeds by neuro-interventional procedures is already well established. I did the first IR treatment of aortic dissection by endovascular means in the Arab Middle East, about 12 years ago. Awareness of what we can do is increasing and this will lead to growth.

Specifically, I think people are becoming more aware of the role of endovascular management in cases that were perhaps not referred so frequently before. If we consider ruptured aortic aneurysms and dissections, now that people know we are offering endovascular management for these patients they frequently ask if they can refer to IR. So I think endovascular management of major arteries is probably, at least in Lebanon, going to be a growth area.

The growth area in referrals for us is not the number of patients arriving at our emergency department but rather that more emergency cases are coming from other hospitals. They may not have IR facilities and would usually offer surgery, but they are increasingly aware that we are available, offer a 24/7 service, and that multidisciplinary care involving IR saves lives.

A.M.

www.aubmc.org

5 minutes with...
Dr. Otto van Delden

Dr. Otto van Delden is one of Europe's foremost trauma IRs, and helped co-author CIRSE's new European Standards of Practice Trauma Guidelines (see page 17).

IQ talks to the Chairman of the Dutch Society of IR (NGIR) about trauma, training and 24-hour care.

What can IR do for trauma patients?

IR plays a huge role in treating polytraumatised patients – not the broken bones, but the more serious bleeding injuries, such as result from road traffic accidents. Anywhere else in Europe this would mean car accidents, but in the Netherlands we also get bike accidents! Stopping bleeding is what we do best, and stabilising a patient is imperative before other therapies, such as bone-setting, can be started. For this reason, our colleagues are eager to have us on their team, and we enjoy a very cooperative relationship.

How is collaboration organised in your hospital?

It is important to have a good relationship with other specialties. In our hospital, the trauma surgeons know exactly what we can offer, and we have a very tight cooperation with them. Our dedicated trauma team consists of an anaesthesiologist, surgical residents, radiology residents, trauma surgeon, radiologists: as soon as the patient comes in, everybody's there, ready to discuss the case and get to work. It's a fixed team, everybody knows each other. Together, we have established a set of criteria for patients who are suitable for angiographic treatment, patients who should undergo conservative treatment or non-operative treatment, and patients who require immediate surgery.

So how do you decide when to perform IR and when not to?

It's very important to get early CT – and that both trauma surgeon and IR are able to look at their own CT scans and see whether there's active bleeding. Patient protocol is partly decided based on clinical signs (haemodynamic stability, haemoglobin, blood pressure, coagulation), and partly on CT. CT findings are the best discriminator for the need to embolise versus no need to embolise. So the quicker and the better the access to CT, the better you can select patients for treatment.

> Our colleagues are eager to have us on their team

> The quicker and the better the access to CT, the better you can select patients for treatment

How can CT access be improved?

In our hospital we actually have the CT scanner right within the trauma bay, so you can get your CTs done instantly. The CT scanner slides in on rails over the trauma table. So you don't have to move the patient at all and you get your CT scan right away (see page 19).

Is this set-up common in the Netherlands?

This kind of access is being pursued as part of our national Level I Trauma Centre plan. The country is being divided up into different areas, and every area has a dedicated trauma centre that will have everything available 24 hours – including IR. Indeed, starting next year, a 24/7 on-call rota will be a prerequisite to being registered as an interventional radiology service in the Netherlands. The trauma centres also aim to get the CT scanner as close to the trauma bay as possible. A similar move is taking place across Europe.

How can other IRs achieve such good working relations with other disciplines?

Our hospital has had a long history of IR, and our good contact with the surgeons and GI doctors predates my arrival. But many hospitals don't have this infrastructure, and when starting up a service you really need to get in touch and simply tell them what you can do. A colleague of mine from Germany has moved from one hospital to a

smaller one, and he was astounded that doctors there didn't know that you could refer patients to him for all kinds of interventions – they just didn't know. And I guess the same goes for hospital administrators: they don't know what you can do unless you tell them yourselves. But the most important thing is being there when the patient case is discussed, that is when you can contribute with an IR solution.

It's funny how even in a big academic hospital like ours, despite these official structures for communicating and consulting each other, lots of things just happen based on your personal networking skills. But radiologists are, by definition, good networkers, because they've to communicate with all different types of specialties. Or at least they should be: communicating with colleagues is one of the main things that we do, and we should make sure we do this.

Every area has a dedicated trauma centre that will have everything available 24 hours – including IR

Why did you become an IR? What was it about it that attracted you?

When I was a medical student, I came into contact with IR while doing research for our surgery department and the GI department. I found their biliary and bleeding procedures fascinating. I like to work with my hands, rather than only watch films, and seeing people doing real-time image-guided procedures really appealed to me.

But, like many, I found out about it by chance. Students need to be told all of this. Many medical students know nothing about radiology: they think it's very boring, but if they found out about the exciting clinical applications, you might attract the more surgically oriented types, the doers. I often think we need to market ourselves to the more hands-on students, rather than the traditional

> "IR is exciting – the techniques require skill and practice and patience, and in the end you can stop a patient bleeding when nobody else can. It's almost like a magic trick, and is hugely satisfying to perform. But it's not about that: it's about a multidisciplinary treatment board deciding what's best for whom. Because once you know how to do the trick, the interesting part becomes discussing patients. That's what's really interesting."

diagnostic personalities that radiology attracts. We really need to make sure that medical students know all their options before specialising.

What would you say to a medical student considering IR?

IR is incredibly rewarding. Depending on what cases you tend to handle, your experience with patients and colleagues will be different, but it's important to approach IR as a clinician: your career will be more people-oriented than traditional radiology. In a way, trauma might be the one field where that isn't the case.

The patient comes to my angiosuite and I save his life, and that's the last I see of him. He may not even know what I've done – much of the time, the patient won't even see me. But knowing that you've saved a life, especially a young life, is all the reward you need.

C.M.

The Academic Medical Center (AMC) is one of the foremost research institutions in the Netherlands. It is a university hospital affiliated with the University of Amsterdam. The complex also houses the Netherlands Institute for Neuroscience, the medical department of the Royal Tropical Institute and a number of biotech companies, making the AMC an ideal centre for research and collaboration.
It is particularly famed for its Level I Trauma Centre, which provides the highest level of surgical care to trauma patients 24 hours a day. The AMC is a leader in trauma education, and is a referral resource for communities in nearby regions, serving a population of 1.6 million.

The Changing Shape of Illness

How rising obesity is creating new challenges for IR

We all know that obesity is on the rise, but even with that knowledge, the bare figures are shocking. According to the World Health Organization, obesity has more than doubled since 1980, meaning that in 2008, 1.5 billion adults were overweight. Although more prevalent in the affluent West, this trend is increasingly witnessed in nations such as China and India.

These 1.5 billion adults, along with an estimated 43 million overweight children, face huge health risks as a result. 2.8 million adults die each year as a result of being overweight, but that is not all – excessive weight is thought to be the leading factor in 44% of the diabetes burden, 23% of ischaemic heart disease, and 7-41% of certain cancers[1].

But the effects do not end there. In addition to causing major health risks, such as stroke, diabetes, joint disorders and cancers, being overweight can also hinder the diagnostic and treatment process. So much so, in fact, that several obstetricians in Florida even imposed weight cut-offs when accepting patients for treatment[2]. What considerations could induce professional carers to refuse treatment to those who need it?

The challenges of larger patients

There are factors that all medical facilities face when caring for overweight or obese patients. Hospital gowns, wheelchairs, blood pressure cuffs and showers are often not big enough to cater for these patients, and many an overweight patient has had to endure the embarrassment of wearing two gowns tied together. Examination tables and trolleys are often not designed to withstand above-average body weights. Administering anaesthesia is more difficult. The bore of diagnostic machines such as MR and CT is usually not wide enough.

In the Netherlands, extremely obese patients in need of CT must often resort to being scanned in the veterinary hospital in Utrecht, which houses a special CT with a large bore. Adequate measures should be taken in order to avoid the embarrassment of having to use such facilities.

Thankfully, the medical industry is responding to these challenges, and many hospitals now have extra-large hospital gowns and wheelchairs available, should they be needed, and trolleys that can withstand the additional weight. Larger MRIs and CTs, with bores up to 90cm and capable of supporting 300kg, are also being developed – but the problems that radiologists face go far beyond that of merely fitting a patient into the scanner.

Diagnostic problems

It is a sad irony, but the very condition that is likely to cause health problems such as heart disease and cancers can also make it harder to identify those same problems. Imaging devices work on complex scientific calculations, producing rays that will penetrate the flesh without causing harm, and pick up the correct information needed to construct an image.

Most imaging devices are designed to image average-sized people, and when the rays that allow visualisation of the body's inner workings, be they X-ray, ultrasound or MR, have to traverse a deeper layer of flesh, the results can be compromised. The relative size difference between average and overweight patients means that the imaging tools being used are relatively weaker, when used on the larger patient. This is especially common in large patients with suspected DVT, coronary artery disease and breast cancers, who must often undergo more invasive testing, or in whom the condition can be missed.

Between 1989 and 2003, inconclusive reports that were "limited by body hiatus" nearly doubled at Massachusetts General Hospital, despite advances in technology during the same period. The hospital concluded that larger patients were at greater risk of misdiagnosis, especially for abdominal ultrasound, chest X-ray and abdominal CT imaging. This led to the higher monetary and psychological costs of longer stays, further testing and misdiagnosis.

Why bigger patients cause bigger challenges

The most obvious challenge faced by radiographers is that of beam penetration. For modalities that utilise ionising radiation (plain X-rays, fluoroscopy, CT), the strength needs to be increased in line with the tissue being imaged. However, increasing radiation doses is dangerous for both patient and clinician, and raises the risk of cancers and erythema (a rash or burn at the point of entry, caused by radiation damage). X-rays tubes also burn out faster as a result.

MR

A similar situation exists with MR – current machines (regardless of bore size) tend to be built to generate 1-1.5 Tesla of magnetic field. While this frequency is adequate for patients of average size, it is often not strong enough to penetrate larger patients. Luckily, MR machines have been recently developed which generate 3 Tesla, and have 70cm apertures or are open.

Ultrasound
Ultrasound is perhaps the most affected of all modalities. Fat causes quite pronounced sound attenuation, and diagnostic quality can be compromised in even slightly overweight patients. Better images can be attained by altering the settings used, such as lowering the frequency of the transducer and use of tissue harmonic imaging.

Moreover, with all these modalities, visualisation is restricted by the bore and reconstruction field of view. The occupational hazards raised by increasing the X-ray and magnetic fields is also accompanied by the higher likelihood of acute and chronic injuries to technologists and support personnel during moving or positioning of large patients.

IR and the issue of obesity

Although there are no hard data for how often IRs encounter these problems, it is likely that many do. Indeed, obesity is a leading cause of heart disease, stroke and cancers, conditions that can all be treated with IR. Added to this, there exist several trials that examine the role of obesity in IR outcomes[3].

These trials have had mixed results, with, on the one hand, obese patients facing worse outcomes following the placement of drug-eluting stents for coronary disease, and on the other, overweight patients having had a better 5-year survival rate following percutaneous coronary intervention (PCI), although this may be due to a more rigorous medical regimen than to any protective effects of body fat[4].

It is clear that interventional radiologists are not unaffected by the radical rise of obesity among the population – with European obesity rates tripling between 1990 and 2006[5], it seems unlikely that they could avoid it. They must also seek to adapt their working practices to cater for larger patients, not just in terms of the size and composition of equipment (needles, closure devices, catheters, stents, etc.), but also in terms of diagnostic protocol.

A bigger but better future

Specific protocols are already in place for dealing with the smallest members of the public – children – and it would be wise for hospitals to establish set protocols for imaging larger patients as well. It is also advised that all equipment have a maximum patient size explicitly stated.

New larger equipment is expensive, and perhaps hospitals would do well to discuss the possibility of setting up a regional centre that can cater for larger patients, in much the same way as dedicated stroke and trauma units exist. It is a concern for all medical providers, and there is no clear solution to the problem.

What is certain, however, is that the radical change in average body sizes is impacting the way that medical professionals provide their services. As with clothes stores, cinemas and public transport, modern hospitals are being forced to reconsider their facilities – the changing waistlines of Europe are changing the face of medicine too, and this includes IR.

IR has offered a gentle alternative to an array of invasive procedures, who knows what is on the horizon – perhaps bariatric IR, a gentler alternative to bariatric surgery?

C.M.

1 *WHO Fact sheet No. 311 – Obesity and Overweight, March 2011.*
2 *"Some ob-gyns in South Florida turn away overweight women", Sun Sentinel, 16.05.2011.*
3 *Zhi Jian Wang et al., Effect of Obesity on Repeat Revascularization in Patients Undergoing Percutaneous Coronary Intervention With Drug-Eluting Stents, Obesity, 2011.*
4 *T. Lancefield et al., Is there an obesity paradox after percutaneous coronary intervention in the contemporary era? An analysis from a multicenter Australian registry, JACC Cardiovasc Interv, June 2010.*
5 *Leo Cendrowicz, Will Europe Green-Light New Food Labels? Time Magazine, March 2010.*

Overcoming Every Hurdle

How IR saved a horse's life

IR techniques are now being used in the veterinary field, with specific IR procedures for animal complaints emerging and gaining acceptance. However, in the 1990s, it was practically unheard of to treat an animal with such a sophisticated technique, and it took a few strange, isolated emergencies for the crossover of IR into the animal realm to take place.

Tony Nicholson, IR, told IQ about one such case which occurred in 1995, when he was asked to tend to a very unusual patient…

It all started with a phone call from a university veterinary department in Neston, in the north-west of England. They had a very valuable horse, a show jumper, which was bleeding to death. It's quite a common condition – horses eat hay, hay gets wet, hay gets infected with fungal spores. Horses then breathe in the fungal spores – the same sort of spores that you might see in your bathroom when the tiles go black – *Aspergillus*.

Horses don't have a eustachian tube like we do between the back of the pharynx and the ear to equalise pressure. Theirs expands out into what's called a guttural pouch, which is a large cavity, and on either side of that guttural pouch run the carotid arteries: the external carotid artery to the face and head, and the internal carotid artery to the brain. Those spores get into the guttural pouch and begin to grow in there. They weaken the walls of one or both of those arteries so that they balloon out in what's called a mycotic aneurysm. That aneurysm then ruptures, and sadly it's not uncommon for a horse to essentially die from a nosebleed.

Usually, all that can be done is to transfuse blood from another horse and hope the sick horse stops bleeding, but this is impractical and too expensive for all but the most valuable of horses – racing stallions, breeding mares or show jumpers. This particular horse was a show jumper of some fame, and the bleeding wasn't stopping.

A plan is formed

The owner of the horse had a friend who was a medical physicist familiar with IR, and he had said, "If he were a human, he'd probably be embolised." So they started ringing around. This was a Sunday and they couldn't contact anybody nearby, so they kept moving on across the country until they reached us in Yorkshire.

I found the case fascinating, so I contacted a neuro-radiologist colleague called Chris Roland-Hill. We went to our hospital, gathered together bits of embolisation equipment that were going out of date, and drove across to Neston, where we were confronted by a team of veterinary surgeons and veterinary anaesthetists busy transfusing the horse.

The guttural pouch, through which the carotid arteries run, can be invaded and damaged by spores. © Western Horseman

Operation IR

Anaesthetising a horse requires a large team of people to stand at one side of it, because it will fall sideways and they're monstrously big and heavy. The hooves are covered in cloth and attached to ropes which lead up to a rail on the ceiling. A pulley system allows the horse to be lifted so it's upside down, hanging from the ceiling. It's then run across into the theatre onto a big waterbed, because if you put them onto anything solid when they're lying like that, they'll never get up again.

You have approximately 1 hour and 15 minutes to get the job done, because after that time their lungs won't re-expand and they won't survive: so you have to work very fast.

On that first occasion we hadn't expected the sheer size of the horse, and we quickly realised that we weren't going to be able to get a normal needle into the carotid artery. We certainly couldn't go from the groin; it was much too far, so we had to puncture the carotid artery directly. That involved a cut-down onto the carotid artery by the veterinary surgeon.

Dr. Tony Nicholson, an IR at Leeds General Infirmary, performed pioneering work on critically ill racehorses in the 1990s, and advised the Liverpool Veterinary School at Neston.
Dr. Nicholson told us "I'm actually terrified of horses, but I found I don't mind them so much once they're unconscious."

> The horse woke about 15 minutes later, staggered to its feet looking rather groggy, and eventually made a full recovery, taking part in several show jumping events before retiring

One of Dr. Nicholson's patients resumes their successful career. Image by permission of Tony Nicholson

Back in 1995 we didn't have good imaging equipment, just an old veterinary orthopaedic c-arm, but because the horse was so large we couldn't see an awful lot with that. So the vet put an endoscope into the horse's nose, into the guttural pouch itself, and he put the endoscope directly on the aneurysm so that when we went up we could see which carotid artery we had to go to with the wire and catheter.

The aneurysm was on the internal carotid, and we used inflatable and detachable balloons above and below the aneurysm. We completed the whole procedure and had the horse sewn up within 60 minutes. It was then hauled back up onto the ceiling and taken across, put into a booth, and sure enough, the horse woke about 15 minutes later, staggered to its feet looking rather groggy, and eventually made a full recovery, taking part in several show jumping events before retiring to stud.

A new chapter in veterinary medicine

I subsequently got called to two more horses, one a race horse, the other a show jumper. The race horse unfortunately wasn't able to race again, but the show jumper actually did go back to show jumping and was able to continue its career. There was a lot of interest in the cases at the time and we advised the Liverpool veterinary school about the procedures, and eventually they were able to do it themselves.

People say horses are very intelligent, but in actual fact, you can take out half their brain (which we effectively did by embolising a carotid artery), and by and large, they're perfectly fine, other than maybe having a bit of trouble running the right way round a bend. I'm sure there were neurological complications, if you had been able to examine them properly, but they were perfectly happy horses gambling around in a field, just not the brightest anymore! The second show jumper had its aneurysm on the external carotid artery, not the internal, so we didn't hurt the brain at all.

We only got one negative reaction: when it first appeared in the newspapers and in Horse and Hound, my chief executive apparently exploded and bellowed, "Don't tell me they've been bringing horses into our CT scanner out of hours!?" Because the newspapers of course didn't tell the whole story, they just said that we'd performed these cases – in reality, the horses hadn't been anywhere near a CT scanner, but it did sound as though we'd trotted them up two flights of stairs and done them in the catheter lab on a Sunday afternoon!

C.M.

Trials and Registries

Trial: a study carried out with the purpose of testing a new medical treatment on a defined group of people. The results are compared with a group that are treated using another method and/or a control group.

Registry: a (retrospective) collection of data about a certain treatment or illness. Using the compiled data, conclusions can be drawn about effectiveness of a particular treatment method.

Angioplasty

Paclitaxel Balloon versus Standard Balloon in In-stent Restenoses of the Superficial Femoral Artery (PACUBA I)

Contact
Prof. Johannes Lammer, Medical University Vienna, AT
Date opened
November 2010
Status
Recruiting

Description
The aim of this study is to evaluate the morphological and clinical efficacy of Paclitaxel-eluting percutaneous transluminal angioplasty (PePTA) for the reduction of restenosis in SFA and PA stents compared to standard percutaneous transluminal angioplasty (sPTA).
ClinicalTrials.gov Identifier: NCT01247402

Supervised Exercise or Angioplasty for Intermittent Claudication due to an Iliac Artery Obstruction (SUPER)

Contact
Dr. Mark J.W. Koelemay, Academic Medical Center Amsterdam, NL
Date opened
November 2010
Status
Recruiting

Description
The purpose of this study is to compare the clinical-effectiveness and cost-effectiveness of two treatment strategies for intermittent claudication (IC) due to an iliac artery obstruction.
ClinicalTrials.gov Identifier: NCT01385774

www.intervention-iq.org
www.clinicaltrials.gov
www.cirse.org
www.controlled-trials.com
www.who.int/trialsearch
http://clinicaltrials.mayo.edu

Embolisation

Supplementary Angiographic Embolization for Peptic Ulcer Bleeding

Contact
Dr. Ove B. Schaffalitzky de Muckadell, Odense University Hospital, DK
Date opened
September 2009
Status
Recruiting

Description
Peptic ulcer bleeding is a common disorder. In this study the investigators examine whether combined endoscopic haemostasis and angiographic embolisation result in a better outcome than the traditional use of endoscopic haemostasis alone.
ClinicalTrials.gov Identifier: NCT01125852

Bronchial Artery Embolization and Medical Measures in Non Severe Acute Hemoptysis of Mild-moderate Abundance (ARTEMHYS)

Contact
Dr. Muriel Fartoukh, Tenon Hospital, FR
Date opened
March 2011
Status
Not yet recruiting

Description
A multicentre randomised trial comparing bronchial artery embolisation combined with medical measures to medical measures alone in the treatment of non-severe acute haemoptysis of mild-to-moderate abundance.
ClinicalTrials.gov Identifier: NCT01278199

Embolectomy

Mechanical Retrieval and Recanalization of Stroke Clots Using Embolectomy (MR RESCUE)

Contact
Dr. Chelsea S. Kidwell, UCLA Medical Center, US
Date opened
May 2004
Status
Recruiting

Description
The purpose of this study is to compare the effectiveness of treating acute ischemic stroke with mechanical embol - ectomy using the Merci Retriever or the Penumbra System within 8 hours of symptom onset to standard medical treatment.
ClinicalTrials.gov Identifier: NCT00389467

Pulmonary Embolism Response to Fragmentation, Embolectomy and Catheter Thrombolysis (PERFECT)

Contact
Dr. William T. Kuo, Stanford University School of Medicine, US
Date opened
January 2009
Status
Recruiting

Description
A prospective observational study to evaluate the safety and effectiveness of catheter-directed therapy (CDT), including percutaneous mechanical thrombectomy (PMT) for treatment of acute pulmonary embolism (PE).
ClinicalTrials.gov Identifier: NCT01097928

HIFU

Therapeutic MRI Guided High Intensity Focused Ultrasound Ablation of Uterine Fibroids (HIFU)

Contact
Dr. Elizabeth David, Sunnybrook Health Sciences Centre, US
Date opened
June 2011
Status
Recruiting

Description
The goal of the study is to collect supplementary 3T treatment safety and technical effectiveness data in a 1-month follow-up study. Safety, quality of life, and imaging endpoints of MR-guided HIFU will be evaluated in all study patients.
ClinicalTrials.gov Identifier: NCT01141062

Oncology

Effectiveness of Microwave Ablation of Hepatocellular Carcinoma as Compared to Radiofrequency Ablation

Contact
Dr. Kit-Fai Lee, The Chinese University of Hong Kong, HK
Date opened
April 2011
Status
Recruiting

Description
The purpose of this study is to compare microwave ablation using the Acculis Microwave Tissue Ablation (MTA) System with conventional radiofrequency ablation (RFA) using Covidien cool-tip radiofrequency needle in patients with localised unresectabe hepatocelluar carcinoma.
ClinicalTrials.gov Identifier: NCT01340105

Preoperative Embolization in Surgical Treatment of Spinal Metastases

Contact
Prof. Lars Lönn, Rigshospitalet, DK
Date opened
May 2011
Status
Recruiting

Description
The main purpose of this study is to assess the efficacy of preoperative embolisation in decreasing operative blood loss, decreasing the need for intraoperative transfusion and facilitating surgical resection in metastatic spine surgery.
ClinicalTrials.gov Identifier: NCT01365715

Vertebroplasty

A Trial of Vertebroplasty for Painful Acute Osteoporotic Vertebral Fractures (Vertos IV)

Contact
Dr. Willem Jan van Rooij, St. Elisabeth Ziekenhuis, NL
Date opened
January 2011
Status
Recruiting

Description
A randomised sham controlled trial of vertebroplasty for painful acute osteoporotic vertebral fractures. Primary outcome will be pain relief at 1 day, 1 week, and 1, 3, 6 and 12 months.
ClinicalTrials.gov Identifier: NCT01200277

Comparative Study of Balloon Kyphoplasty and Conservative Treatment (TRAUMAA1-2-3)

Contact
Dr. Jean-Denis Laredo, Hôpitaux de Paris, FR
Date opened
December 2007
Status
Recruiting

Description
This study will compare two treatments in acute stable traumatic vertebral fractures: 1) conservative orthopaedic management 2) percutaneous balloon kyphoplasty.
ClinicalTrials.gov Identifier: NCT00749242

Please note that this does not constitute an exhaustive overview of Trials and Registries. If you are aware of a Trial or Registry which may be of interest to our readers, please feel free to contact us at info@intervention-iq.org.

IQ takes no responsibility for the content of the individual trials; please refer to their Source for further information.

The Early Days of IR

Image courtesy of Interventional News

Like so many IR pioneers, Anders Lunderquist had no idea what professional path fate would take him down. But a curious mind takes many unusual turns along its journey, and that, as the American poet Robert Frost said, has made all the difference.

Anders Lunderquist's path to IR innovation began with a love of wildlife and biology that has lasted his whole life. This led him to select medicine as a suitable profession, and he began his studies in the mid-1940s. By 1949, he was deeply involved with renal function research – so much so, that he took a three-year break from his medical studies to continue this research.

"As a medical student I became involved in ongoing work to develop an artificial kidney at the Medical Faculty of University of Lund, Sweden. Prof. Nils Alwall was leading this pioneering research, and it was a fascinating project to be involved with. Alongside performing dialysis on nephrectomised rabbits, I also became interested in a related phenomenon.

"Patients with renal failure often developed a specific pulmonary oedema, and I wanted to investigate this in the uremic rabbits. This led me to develop an X-ray technique to study the rabbit lung. Consequently I became interested in radiology and applied for a position as the Radiology Department as soon as I graduated from the Medical School."

It was to be a fateful and fruitful decision, which was to the lay the foundations of a brilliant career:

"My involvement began in the early phase when angiography was used diagnostically. I wrote my thesis on the vascular changes in pancreatic carcinoma.

"The transition to interventional radiology came during a study of liver tumours. We were investigating changes of the portal vein produced by the tumours, by catheterising the umbilical vein. During one such procedure, the catheter entered a small side branch. Contrast injection showed this to be the posterior superior pancreaticoduodenal vein, which I well recognised from my previous studies on pancreatic carcinoma. I suggested to the endocrine surgeon that this technique be used in localisation of pancreatic endocrine tumours."

Prof. Lunderquist has often spoken of the benefits of collaborating with similarly passionate minds, and how this can inspire new ideas. Unfortunately, the early days of IR were somewhat lonely ones:

"At that time very few doctors in Sweden were investigating IR techniques, but I was favoured by close contacts with Dr. Stanley Baum in Boston, Drs. Sidney Wallace and Caesare Gianturco in Houston and Dr. Joseph Rösch in Portland. When Dr. Krassi Ivancev came to Lund in the 1980s, we developed a very fruitful collaboration in IR together."

Anders Lunderquist
"Inventor of the Lunderquist guidewire"

- 1955, medical degree, University of Lund, Sweden
- 1965, PhD from University of Lund
- 1970-1990, Head of Gastrointestinal Radiology, Angiography and Interventional Radiology at University of Lund
- 1990-2003, organised International Practical Training Courses in Interventional Radiology
- Gold Medallist at ECR, SCVIR and CIRSE

While best known for his eponymous guidewire, Prof. Lunderquist has made many other contributions to the development of the speciality, although some, such as his technique to sample pancreatic veins, have been replaced by advances in imaging. Nonetheless, these were to have great clinical impact at their time of discovery.

Prof. Lunderquist retired from clinical work in 1990, but his enquiring mind has been far from idle. He initiated a much-needed series of IR training courses in collaboration with Bill Cook and Sidney Wallace, as well as continuing his research in the interventional sphere:

"In the late 1990s, I happened to meet a perfusionist, Mats Allers, who was working in thoracic surgery in Lund. A perfusionist is responsible for extracorporeal circulation during chest surgery, and in order to reduce the risk of brain damage, Mats often reduced the body temperature to around 15°C. However, whole-body cooling is an inefficient approach, and we discussed various methods of inducing selective brain hypothermia. Over the next ten years, we developed a technique to selectively cool the brain via the nasal cavity, using thin-walled balloons perfused with cold saline. Experimental studies in pigs, and finally in human volunteers, have demonstrated that this is a successful method to protect an ischaemic brain."

It is this dedication, beyond the call of duty, which makes Anders Lunderquist rightly regarded as one of the great pioneers of IR.

With sincere thanks to Prof. Anders Lunderquist

C.M.

What's in store

Coming up in Issue 6, March 2012

Venous Interventions

... The Quarter's Focus

Venous Interventions
Image-guided minimally invasive treatment for varices in the spotlight

Venous problems are a common condition in our society. Often attributed to a lifestyle that involves prolonged standing or sitting, these gnarled, enlarged and discoloured veins have caused many a person to reconsider their summertime attire.

But this is far from a purely cosmetic complication. If symptomatic and left untreated there is a risk of developing more serious conditions such as:

- phlebitis (inflammation of the vein wall)
- eczema
- leg ulcers

IQ will discuss these and a variety of venous problems as well as present the interventional selection of minimally invasive treatments that show lower recurrence rates and are far gentler on the patient.
Pick up our next copy and read all about foam sclerotherapy, radiofrequency ablation, endovenous laser therapy and much more...

Also featured:

- **Deep Vein Thrombosis (DVT)**
- **Health Economics – IR and Cost-effectiveness**
- **Dedicated vs. Integrated IR Structures**

If you are interested in contributing to IQ, please contact
info@intervention-iq.org

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